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OBSERVATIONS ON ANOPHELES LEUCOSPHYRUS DON. AT SHINGBWIYANG, BURMA

(DIPTERA, CULICIDAE)

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Shingbwiyang lies at one end of the broad Hukawng valley in Northern Burma at approximately 26 degrees 40″ N—96 degrees 12″ E. The Ledo Road, after descending circuitously and sharply down steep mountains at the northwest end of the valley, follows along the Tawa River (a tributary of the Tanai) until the river bends southward. The road then makes a sharp bend around one end of the airstrip and becomes ribbon proceeding east-southeast through the valley. On either side of the airstrip, and adjacent to the river, there are numerous flat swamps, some open and other densely wooded. North of the road, the land rises sharply in extremely jagged and irregular hills with dense jungle vegetation and innumerable winding streams. The soil is soft and deep so that large ruts and holes are formed wherever vehicles travel. Clearing of camp sites provided all degrees of shade on various pools which form everywhere throughout the rainy season, from April through September. The streams and rivers have numerous large rocks with potholes etched in them. These holes become filled when the streams are high or during the rains and they retain the water for long periods. Rocks, fallen trees, and brush serve to form relatively slow-flowing pools in the streams. This great variety and abundance of water affords ample opporunity for the development of mosquitoes of various species throughout the area.

BREEDING HABITS OF ANOPHELES LEUCOSPHYRUS

A. leucosphyrus larvae were first found in pot-holes in large rocks along the river and among floatage in pools of mountain streams, in March 1944. Since then, they have been found in a great variety of habitats, as follows: standing water in rain puddles with either muddy or grassy bottoms, slit trenches in bright sunlight or shaded by tall grass and trees, a large reservoir formed by damming a stream, a tiny rain puddle in a footprint inside a tent, in rock potholes with clear water or with water made brown from decaying leaves, shallow seepage pools, small shady swamps, and even artificial containers—old tin cans and barrels. Table I shows the relative abundance of

the larvae of this species at Shingbwiyang by monthly periods. It appeared in early March, showing a marked increase in early May, and became the predominant species in late May. Throughout June and July it was found in over 50% of the collections, and more than 60% of all larvae identified were this species. Another increase was noted in October and early November.

Few rearings were attempted, mostly from pupae collected in the field. Table II indicates that *A. leucosphyrus* comprised over 50% of all adults reared in June and July, correlating well with the predominance of larvae of this species during those months.

TABLE I: *Anopheles leucosphyrus* Larvae in Collections at Shingbwiyang.

Month	No. of days on which collections were made	Larval collections Containing Total Number	*A. leucosphyrus* Number	*A. leucosphyrus* Percent	Anopheline larvae identified All Species Number	*A. leucosphyrus* Number	*A. leucosphyrus* Percent
Feb.	12	28	0	0	579	0	0
March	21	46	10	22	1163	49	4
April	18	48	4	8	905	36	4
May	21	44	13	30	1009	181	18
June	17	47	24	51	706	478	68
July	19	33	24	72	573	347	61
August	16	26	5	19	340	32	9
Sept.	19	32	8	25	490	27	6
Oct.	17	37	14	38	417	81	19
Nov.	10	25	11	44	608	126	20
Dec.	14	16	9	56	417	97	23

TABLE II: *Anopheles leucosphyrus* Adults Reared at Shingbwiyang.

Month	Total *Anopheles* reared Number	*Anopheles leucosphyrus* reared Number	*Anopheles leucosphyrus* reared Percent
April	90	5	6
May	185	50	27
June	162	143	88
July	255	147	58
August	62	8	13
Sept.	88	40	45
Oct.	105	53	50
Nov.	87	63	72
Dec.	29	4	13.4

ADULT COLLECTIONS

Table III shows the total anopheline adults of all species and of *A. leucosphyrus* caught from May through November.

The latter species was predominant throughout June, July, and August comprising 80% or more of all adults captured during the latter two months. The great majority of all specimens were found outdoors in abandoned machine-gun dugouts, mossy slit trenches, dark embankments and on tree trunks, but a few were caught inside tents and warehouses proving that they do enter human habitations in search of a blood meal. Relatively few searches for adults were made after August, but even in apparently ideal resting places, including many in which adults had previously been captured, practically none was found. No adult searches were made outside the controlled zone. The reduction in the October and November collections may be partially attributed to the fact that the area was sprayed from the air with 5% DDT oil solution on 28 September, 12 October, and 18 November 1944. Residual spraying of quarters with 5% DDT oil solution was also initiated at this time, and all quarters in the area had been sprayed by early November.

Adult Dissections

Table III also summarizes the dissections made. Of 195 female anopheline mosquitoes dissected, 112 or 57.4% were *A. leucosphyrus* and 3 of this species or 2.7% contained malaria sporozoites in their salivary glands. One infected specimen was caught on a stream bank near warehouses in June and it contained sporozoites typical of human malaria. The other two infected mosquitoes were caught in July in dugouts near horse stables at a Chinese camp. Their salivary glands contained some slightly curved or sickle-shaped rods typical of sporozoites of human malaria, but the majority of the parasites though similar in size and refraction of light were of a peculiar shape resembling miniature sea-gulls seen head-on. That is, there was a central globular mass from which two pointed processes extended at an angle to each other, usually of about 125 degrees, though frequently at a much smaller angle. Slight motility was observed in a few. The explanation of the atypcial appearance of the forms is unknown, but it is possible that it may have resulted from distortion due to technical methods. With Giemsa stain, the central globular portion was reddish-purple and the pointed projections appeared bluish-purple.

Further evidence that *A. leucosphyrus* is a serious malaria vector was obtained in the Ledo, Assam area (mile 9-19). There were 668 adult anopheline dissections made in this area during the period July through November. Of this number, 172 specimens or 25.7% were identified as *A. leucosphyrus*. Four of the dissections of salivary glands were found infected with sporozoites for a 2.3% *Plasmodium* infection rate. All of

the infected specimens were captured at a native labor camp inside of native quarters. These, together with dissections reported in the literature,* indicate that *A. leucosphyrus* is a suitable host for the development of the malaria parasite to the sporozoite stage.

TABLE III: Anopheline Adult Collections and Dissections at Shingbwiyang

Month	No. days searches made	No. of man-hours searching	Total *Anopheles* collected Male	Female	Total *Anopheles* dissected	*A. leucosphyrus* adults Total collected Male	Female	No. dissected Total	Positive
May	8	16	19	20	16	0	0	0	0
June	15	25	34	72	66	15	29	25	1
July	21	43	35	114	108	31	88	83	2
August	13	31	0	6	5	0	5	4	0
Sept.	4	6	0	1	0	0	0	0	0
Oct.	8	12	0	0	0	0	0	0	0
Nov.	7	8	0	0	0	0	0	0	0
Totals	76	141	88	213	195	46	122	112	3
			(301)			(168)			(2.7%)

METEOROLOGY

Weather data are meager for this area as the Army weather bureau station was not established until April and did not have facilities for complete temperature recordings until later. The average monthly temperatures and total precipitation at the air-strip are presented in table IV. The average minimum temperature during June to October inclusive was 72 degrees Fahrenheit, and the average maximum temperature was 88 degrees Fahrenheit, neither varying more than 6 degrees from one month to another during this period. The total rainfall from April to October inclusive was 161 inches, or 23 inches per month. Three months: June, July, and September averaged one inch or more of rain each day. June had the highest rainfall: 45.47 inches.

These data do not appear to be closely correlated with the abundance of *A. leucosphyrus*, but, in any case, heavy rainfall which appeared detrimental to the breeding of certain other species did not hinder this one.

RELATION TO MALARIA

Plate 4 shows the malaria rate per 1000/year. The sharp rise in the malaria rate correlates significantly with the rain-

*Clark & Choudbury, June, 1941. Journal of Malaria Institute of India.

Covell, G., Dec., 1944. Journal of Malaria Institute of India.

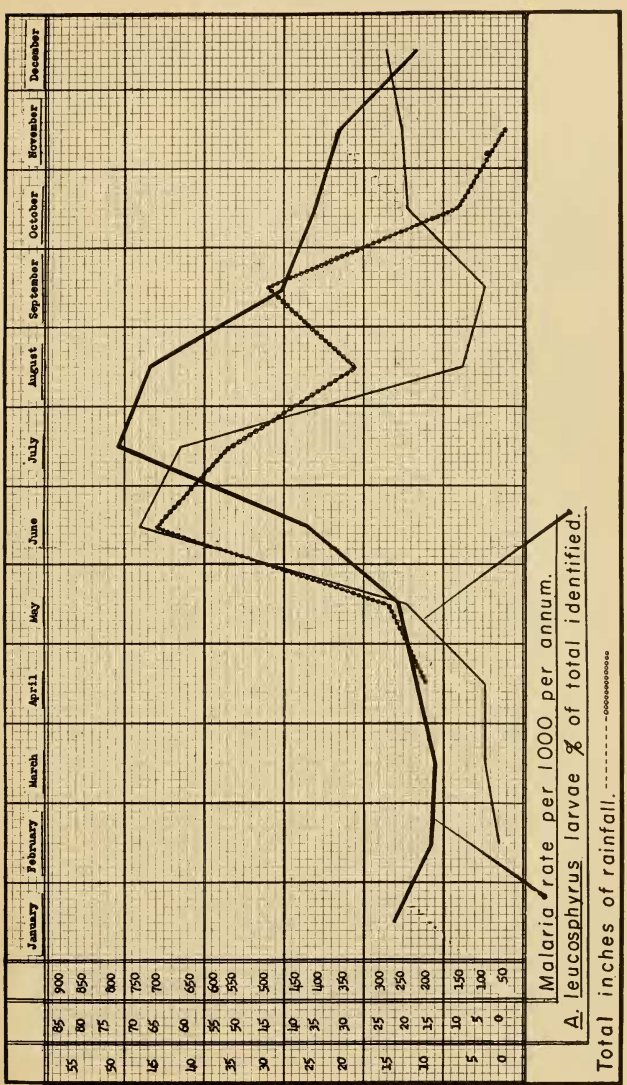
January
February
March
April
May
June
July
August
September
October
November
December
Malaria rate per 1000 per annum.
A. leucosphyrus larvae % of total identified.
Total inches of rainfall.

TABLE IV: Weather Data at Shingbwiyang Airstrip, 1944.

Month	Average temperatures in degrees Fahrenheit			Total rainfall in inches
	Minimum	Maximum	Mean	
April	?	?	?	10
May	?	?	?	15
June	73	87	80	45
July	74	89	81	36
August	73	91	82	19
September	72	85	78	30
October	68	88	78	6
November	49	83	56	.25

fall and *A. leucosphyrus* breeding graphs. The larval collections reached the highest peak during late May, while the highest malaria incidence rate took place during July. The rise in the larval collections during October and November was not indicated in the malaria incidence. However, adult collections during the same period continued to decrease, perhaps partially attributed to factors already mentioned.

CONCLUSION

Because *A. leucosphyrus* is the predominant species of anopheline mosquito in the Shingbwiyang area during June and July, because it breeds in a wide variety of habitats, because it does enter human habitations in search of a blood meal, and because dissections have shown that this species is a suitable definitive host for the malaria parasite, this species is an efficient vector of malaria in this area.

ACKNOWLEDGMENTS

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A SYNONYM OF PHEIDOLE DENTATA VAR. COMMUTATA MAYR (HYMENOPTERA, FORMICIDAE)

I wish to call to the attention of myrmecologists a synonym of *Pheidole dentata* var. *commutata* Mayr. In 1938 (Amer. Midl. Nat. 19:238) I described some workers of this variety as *Leptothorax tennesseensis*. Since that time it has been found that the specimens belong to *Pheidole dentata* var. *commutata* Mayr and the name *Leptothorax tennesseensis* Cole must therefore be relegated to the synonomy.

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